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1 [ATUM: a new technique for capturing address traces using microcode](#)

✉ A. Agarwal, R. L. Sites, M. Horowitz

June 1986 **ACM SIGARCH Computer Architecture News**, Proceedings of the annual international symposium on Computer architecture, 14 Issue 2

Publisher: IEEE Computer Society Press, ACM Press

Full text available: [pdf\(894.10 KB\)](#) Additional Information: [full citation](#), [abstract](#), [citations](#), [index terms](#)

Trace-driven simulation is often used in the design of computer systems, and translation lookaside buffers. Capturing address traces to drive such simulation has been problematic, often involving 1000:1 software overhead to trace a target program and/or mechanisms that cause significant distortions in the recorded data. A new technique for capturing address traces has been developed to use a processor's microcode to map addresses in a reserved part of main memory as ...

2 [Techniques for compressing program address traces](#)

✉ Andrew R. Pleszkun

November 1994 **Proceedings of the 27th annual international symposium on Microarchitecture**

Publisher: ACM Press

Full text available: [pdf\(931.63 KB\)](#) Additional Information: [full citation, abst](#) [citations, index ten](#)

In this paper a technique for generating consistent, reproducible traces w of magnitude better compression than standard general-purpose compres described. With this approach, the trace is read once, an intermediate for then read as the input to the second pass over the address stream. No pro required, and this technique will work on address streams that include O of the way the address trace is encod ...

Keywords: compression, trace generation

3 Address trace compression through loop detection and reduction

✉ E. N. Elnozahy

May 1999 **ACM SIGMETRICS Performance Evaluation Review** , Proc 1999 ACM SIGMETRICS international conference on Meas modeling of computer systems SIGMETRICS '99, Volume 2

Publisher: ACM Press

Full text available: [pdf\(226.94 KB\)](#) Additional Information: [full citation, refer](#) [index terms](#)

Keywords: address traces, compression, control flow analysis, traces

4 Generation and analysis of very long address traces

✉ Anita Borg, R. E. Kessler, David W. Wall

May 1990 **ACM SIGARCH Computer Architecture News** , Proceeding annual international symposium on Computer Architecture 18 Issue 3a

Publisher: ACM Press

Full text available: [pdf\(1.08 MB\)](#) Additional Information: [full citation, abst](#) [citations, index ten](#)

Existing methods of generating and analyzing traces suffer from a variet including complexity, inaccuracy, short length, inflexibility, or applicabi machines. We use a trace generation mechanism based on link-time code

which is simple to use, generates accurate long traces of multi-user programs on a RISC machine, and can be flexibly controlled. On-the-fly analysis of the traces can get accurate performance data for large second-level programs ...

5 RATCHET: real-time address trace compression hardware for extended traces

Colleen D. Schieber, Eric E. Johnson

April 1994 **ACM SIGMETRICS Performance Evaluation Review**, Vol 22, No 1
Publisher: ACM Press

Full text available: [pdf\(783.24 KB\)](#) Additional Information: [full citation](#), [abstract](#), [citations](#), [index terms](#)

The address traces used in computer architecture research are commonly generated by software techniques that introduce time dilations of an order of magnitude. These techniques may also omit classes of memory references that are important for understanding the performance models of computer systems, such as instruction prefetches, operating system calls, and interrupt activity. We describe a technique for capturing all classes of memory references in real time. RATCHET employs trace filtering hardware to reduce the size of the traces ...

6 Constructing instruction traces from cache-filtered address traces (CITCA)

Charlton D. Rose, J. Kelly Flanagan

December 1996 **ACM SIGARCH Computer Architecture News**, Vol 14, No 4
Publisher: ACM Press

Full text available: [pdf\(595.54 KB\)](#) Additional Information: [full citation](#), [abstract](#), [citations](#), [index terms](#)

Instruction traces are useful tools for studying many aspects of computer systems. They are difficult to gather without perturbing the systems being traced. In the past, researchers have collected instruction traces through various techniques, including simulation, instruction inlining, hardware monitoring, and processor simulation. These techniques, however, fail to produce accurate traces because they interfere with the processor's execution. Because processors are deterministic ...

7 TRAPEDS: producing traces for multicomputers via execution driven simulation

C. B. Stunkel, W. K. Fuchs

April 1989 **ACM SIGMETRICS Performance Evaluation Review**, Proceedings of the 1989 ACM SIGMETRICS international conference on Measurement and modeling of computer systems **SIGMETRICS '89**, Volume 17, No 1
Publisher: ACM Press

Full text available: [pdf\(960.90 KB\)](#) Additional Information: [full citation, abst](#) [citations, index ter](#)

Trace-driven simulation is an important aid in performance analysis of computer systems. Capturing address traces for these simulations is a difficult problem for single-processor systems and particularly for multicomputers. Even when existing trace methods can be applied to multicomputers, the amount of collected data typically grows with the number of nodes, so I/O and trace storage costs increase. A new technique is presented in this paper that modifies the executable code to dynamically collect address traces ...

8 [Session 9: traffic analysis: Observed structure of addresses in IP traffic](#)

By Eddie Kohler, Jinyang Li, Vern Paxson, Scott Shenker

November 2002 **Proceedings of the 2nd ACM SIGCOMM Workshop on Network Measurement**

Publisher: ACM Press

Full text available: [pdf\(1.18 MB\)](#) Additional Information: [full citation, abst](#) [citations, index ter](#)

This paper investigates the structure of addresses contained in IP traffic. We analyze the structural characteristics of destination IP addresses seen on the Internet, considered as a subset of the address space. These characteristics may have an impact on network algorithms that deal with IP address aggregates, such as routing lookups and congestion control. We find that address structures are well modeled by a two-dimensional Cantor dust with two parameters. The model matches the observed data ...

9 [Trace-driven memory simulation: a survey](#)

By Richard A. Uhlig, Trevor N. Mudge

June 1997 **ACM Computing Surveys (CSUR)**, Volume 29 Issue 2

Publisher: ACM Press

Full text available: [pdf\(636.11 KB\)](#) Additional Information: [full citation, abst](#) [citations, index ter](#)

As the gap between processor and memory speeds continues to widen, memory system design is an increasingly important. One such method, trace-driven memory simulation, has been a subject of intense interest among researchers and has, as a result, enjoyed significant and substantial improvements during the past decade. This article surveys the developments by establishing criteria for evaluating trace-driven memory simulation ...

Keywords: TLBs, caches, memory management, memory simulation, trace simulation

10 Execution-driven simulation of multiprocessors: address and timing analysis

◆ S. Dwarkadas, J. R. Jump, J. B. Sinclair

October 1994 **ACM Transactions on Modeling and Computer Simulation**
Volume 4 Issue 4

Publisher: ACM Press

Full text available: [pdf\(1.58 MB\)](#) Additional Information: [full citation, abstract](#) [citations, index terms](#)

This article describes and evaluates an efficient execution-driven technique for simulation of multiprocessors that includes the simulation of system memory access driven by real program work loads. The technique produces correctly initialized traces at run-time without disk access overhead or hardware support, allowing simulation of the effects of a variety of architectural alternatives on program performance. We implemented a simulator based on this technique that offers ...

Keywords: distributed systems, execution-driven simulation, parallel traces, memory multiprocessors

11 Designing a trace format for heap allocation events

◆ Trishul Chilimbi, Richard Jones, Benjamin Zorn

October 2000 **ACM SIGPLAN Notices , Proceedings of the 2nd international conference on Memory management ISMM '00**, Volume 36 Issue 1

Publisher: ACM Press

Full text available: [pdf\(1.53 MB\)](#) Additional Information: [full citation, abstract](#) [terms](#)

Dynamic storage allocation continues to play an important role in the performance and correctness of systems ranging from user productivity software to high-performance scientific applications. While algorithms for dynamic storage allocation have been studied for decades, little work has been done to standardize the representation of memory traces. This literature is based on measuring the performance of benchmark programs and applications of many important allocation-intensive workloads. Furthermore, to date, no standard has emerged or been proposed for publishing and exchanging memory traces.

12 Dynamic base register caching: a technique for reducing address bus width

✉ Matthew Farrens, Arvin Park

April 1991 **ACM SIGARCH Computer Architecture News , Proceedings of the annual international symposium on Computer architecture**
19 Issue 3

Publisher: ACM Press

Full text available: [pdf\(948.04 KB\)](#) Additional Information: [full citation, references](#) [index terms](#)

13 Dealing with high speed links and other measurement challenges: On the design

✉ performance of prefix-preserving IP traffic trace anonymization

Jun Xu, Jinliang Fan, Mostafa Ammar, Sue B. Moon

November 2001 **Proceedings of the 1st ACM SIGCOMM Workshop on Measurement**

Publisher: ACM Press

Full text available: [pdf\(697.42 KB\)](#) Additional Information: [full citation, references](#) [index terms](#)

14 An in-cache address translation mechanism

✉ D. A. Wood, S. J. Eggers, G. Gibson, M. D. Hill, J. M. Pendleton

June 1986 **ACM SIGARCH Computer Architecture News , Proceedings of the annual international symposium on Computer architecture**
14 Issue 2

Publisher: IEEE Computer Society Press, ACM Press

Full text available: [pdf\(770.30 KB\)](#) Additional Information: [full citation, abstracts](#) [citations, index terms](#)

In the design of SPUR, a high-performance multiprocessor workstation, caches and hardware-supported cache consistency suggests a new approach to address translation. By performing translation in each processor's virtual memory, the need for separate translation lookaside buffers (TLBs) is eliminated. This substantially reduces the hardware cost and complexity of the translation mechanism and eliminates the translation consistency problem. Translation ...

15Optimal tracing and incremental reexecution for debugging long-running programs

◆ Robert H. B. Netzer, Mark H. Weaver

June 1994 **ACM SIGPLAN Notices**, **Proceedings of the ACM SIGPLAN on Programming language design and implementation PLD**
Issue 6

Publisher: ACM Press

Full text available: [pdf\(1.34 MB\)](#) Additional Information: [full citation, references](#) [index terms](#)

16 Memory-wall: Boosting trace cache performance with nonhead miss speculation

◆ Stevan Vlaovic, Edward S. Davidson

June 2002 **Proceedings of the 16th international conference on Supercomputing**
Publisher: ACM Press

Full text available: [pdf\(179.52 KB\)](#) Additional Information: [full citation, abstract](#) [index terms](#)

Trace caches are used to help dynamic branch prediction make multiple predictions in a single cycle by embedding some of the predictions in the trace. In this work, we propose a trace cache that is capable of delivering a trace consisting of a variable number of instructions using a linked list mechanism. We evaluate several schemes in the context of a trace cache model that stores decoded instructions. By developing a new classification scheme for trace cache accesses, we are able to target those misses to improve the performance of the trace cache.

Keywords: branch prediction, optimization, trace cache, x86

17 Trace cache: a low latency approach to high bandwidth instruction fetching

Eric Rotenberg, Steve Bennett, James E. Smith

December 1996 **Proceedings of the 29th annual ACM/IEEE international conference on Microarchitecture**

Publisher: IEEE Computer Society

Full text available: [pdf\(1.38 MB\)](#) Additional Information: [full citation, abstract](#) [citations](#), [index terms](#)

As the issue width of superscalar processors is increased, instruction fetch requirements will also increase. It will become necessary to fetch multiple instructions in parallel. Conventional instruction caches hinder this effort because long instructions are not always in contiguous cache locations. We propose supplementing the instruction cache with a trace cache that stores decoded instructions.

instruction cache with a trace cache. This structure caches traces of the d stream, so instructions that are otherwise no ...

Keywords: instruction cache, instruction fetching, multiple branch predi processors, trace cache

18 Address compression through base register caching

Arvin Park, Matthew Farrens

November 1990 **Proceedings of the 23rd annual workshop and symposi Microprogramming and microarchitecture**

Publisher: IEEE Computer Society Press

Full text available: [pdf\(689.60 KB\)](#) Additional Information: [full citation, abst](#) [citations](#)

This paper presents a technique to reduce processor-to-memory address l exploiting temporal and spatial locality in address reference streams. Hi§ of address words are cached in base registers at both the processor and m it possible to transmit small register indexes between processor and mem high order address bits themselves. Trace driven simulations indicate tha Caching reduces processor-to-me ...

Keywords: CPU performance, bandwidth, locality, microprocessor syste

19 Mache: no-loss trace compaction

◆ A. D. Samples

April 1989 **ACM SIGMETRICS Performance Evaluation Review , Pro 1989 ACM SIGMETRICS international conference on Mea modeling of computer systems SIGMETRICS '89**, Volume

Publisher: ACM Press

Full text available: [pdf\(798.23 KB\)](#) Additional Information: [full citation, abst](#) [citations, index ter](#)

Execution traces can be significantly compressed using their referencing observation leads to a technique capable of compressing execution trace magnitude; instruction-only traces are compressed by two orders of mag technique is unlike previously reported trace compression techniques in without loss of information and, therefore, does not affect trace-driven si

accuracy.

20 Techniques for efficient inline tracing on a shared-memory multiprocessor

✉ S. J. Eggers, David R. Keppel, Eric J. Koldinger, Henry M. Levy

April 1990 **ACM SIGMETRICS Performance Evaluation Review**, Pro
1990 ACM SIGMETRICS conference on Measurement and
computer systems **SIGMETRICS '90**, Volume 18 Issue 1

Publisher: ACM Press

Full text available: [pdf\(1.12 MB\)](#) Additional Information: [full citation](#), [abst](#)
[citations](#), [index terms](#)

While much current research concerns multiprocessor design, few traces programs are available for analyzing the effect of design trade-offs. Existing methods have serious drawbacks: trap-driven methods often slow down by more than 1000 times, significantly perturbing program behavior; micro modification is faster, but the technique is neither general nor portable. I a new tool, called MPTRACE, for collecting tr ...

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1 [Optimally profiling and tracing programs](#)

Thomas Ball, James R. Larus

July 1994 **ACM Transactions on Programming Languages and Systems**
Volume 16 Issue 4

Publisher: ACM Press

Full text available: [pdf\(2.84 MB\)](#) Additional Information: [full citation](#), [abstract](#), [citations](#), [index terms](#)

This paper describes algorithms for inserting monitoring code to profile programs. These algorithms greatly reduce the cost of measuring programs with respect to the commonly used technique of placing code in each basic block. Programs are measured by the number of times each basic block in a program executes. Instruction tracing is used to determine the sequence of basic blocks traversed in a program execution. The algorithms determine the placement of counting/tracing code with respect to the ...

Keywords: control-flow graph, instruction tracing, instrumentation, profiling

2 [Address calculation for retargetable compilation and exploration of instruction set architectures](#)

Clifford Liem, Pierre Paulin, Ahmed Jerraya

June 1996 **Proceedings of the 33rd annual conference on Design automation**
Publisher: ACM Press

Full text available: [pdf\(54.16 KB\)](#) Additional Information: [full citation](#), [reference](#), [index terms](#)

3 Performance debugging shared memory parallel programs using run-time class

✉ Ramakrishnan Rajamony, Alan L. Cox

June 1997 **ACM SIGMETRICS Performance Evaluation Review**, Proceedings of the 1997 ACM SIGMETRICS international conference on Measurement and modeling of computer systems SIGMETRICS '97, Volume 2

Publisher: ACM Press

Full text available: [pdf\(2.37 MB\)](#) Additional Information: [full citation](#), [abstract](#), [citations](#), [index terms](#)

We describe a new approach to performance debugging that focuses on identifying computation transformations to reduce synchronization and contention. By grouping writes together into *equivalence classes*, we are able to tractably extract information from long-running programs. Our performance debugger analyzes this information and suggests computation transformations in terms of the so-called *equivalence classes*. We present the transformations suggested by the debugger on a suite of four benchmarks.

4 The flight recorder: an architectural aid for system monitoring

✉ Michael M. Gorlick

December 1991 **ACM SIGPLAN Notices**, Proceedings of the 1991 ACM SIGPLAN conference on Parallel and distributed debugging PADD '91, Volume 22 Number 12

Publisher: ACM Press

Full text available: [pdf\(944.95 KB\)](#) Additional Information: [full citation](#), [reference](#), [index terms](#)

5 Active memory: a new abstraction for memory system simulation

✉ Alvin R. Lebeck, David A. Wood

January 1997 **ACM Transactions on Modeling and Computer Simulation**, Volume 7 Issue 1

Publisher: ACM Press

Full text available: [pdf\(690.38 KB\)](#) Additional Information: [full citation](#), [reference](#), [index terms](#)

KB)index terms

Keywords: Cache memory, direct-execution simulation, memory hierarchy simulation, trace-driven simulation

6 The performance enhancement of descriptor-based virtual memory systems using associative registers

◆ R. E. Brundage, A. P. Batson

December 1974 **ACM SIGARCH Computer Architecture News**, Proceedings of the annual symposium on Computer architecture ISCA '74

Publisher: ACM Press

Full text available: [pdf\(539.04 KB\)](#) Additional Information: [full citation, abstract](#) [citations](#)

Contemporary paged virtual memory systems often use associative registers to frequently-referenced pages. Here we examine the analogous use of registers in descriptorbased, symbolically-segmented virtual memory systems. A segment contains an entire data structure as defined in a high-level language. Data from production Algol 60 programs were used to determine performance as a function of the number of associative registers in ...

7 Active memory: a new abstraction for memory-system simulation

◆ Alvin R. Lebeck, David A. Wood

May 1995 **ACM SIGMETRICS Performance Evaluation Review**, Proceedings of the 1995 ACM SIGMETRICS joint international conference on

modeling of computer systems SIGMETRICS '95/PERFOR

Volume 23 Issue 1

Publisher: ACM Press

Full text available: [pdf\(1.28 MB\)](#) Additional Information: [full citation, abstract](#) [citations, index terms](#)

This paper describes the *active memory* abstraction for memory-system simulation---an abstraction---designed specifically for on-the-fly simulation, memory reference invoke a user-specified function depending upon the reference's type and block state. Active memory allows simulator writers to specify the appropriate action for each reference, including "no action" for the common case of cache hits.

abstraction hides implementation details, implemen ...

8 Experience with a software-defined machine architecture

◆ David W. Wall

May 1992 **ACM Transactions on Programming Languages and System**
Volume 14 Issue 3

Publisher: ACM Press

Full text available: [pdf\(2.86 MB\)](#) Additional Information: [full citation, abst](#)
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We have built a system in which the compiler back end and the linker will present an abstract machine at a considerably higher level than the actual intermediate language translated by the back end is the target language of compilers and is also the only assembly language generally available. The intermodule register allocation, which would be harder if some of the code had come from a traditional assembler, out of sight of ...

Keywords: RISC, graph coloring, intermediate language, interprocedural pipeline scheduling, profiling, register allocation, register windows

9 EEL: machine-independent executable editing

◆ James R. Larus, Eric Schnarr

June 1995 **ACM SIGPLAN Notices , Proceedings of the ACM SIGPLAN on Programming language design and implementation PLDI**
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Publisher: ACM Press

Full text available: [pdf\(1.15 MB\)](#) Additional Information: [full citation, abst](#)
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EEL (Executable Editing Library) is a library for building tools to analyze executable (compiled) program. The systems and languages communities have tools for error detection, fault isolation, architecture translation, performance simulation, and optimization using this approach of modifying executable. However, tools of this sort are difficult and time-consuming to write and are tied to a particular machine and operating system ...

10

Constructing instruction traces from cache-filtered address traces (CITCA)

◆ Charlton D. Rose, J. Kelly Flanagan

December 1996 **ACM SIGARCH Computer Architecture News**, Volun
Publisher: ACM Press

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Instruction traces are useful tools for studying many aspects of computer
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execution. Because processors are deterministic ...

11 Techniques for efficient inline tracing on a shared-memory multiprocessor

◆ S. J. Eggers, David R. Keppel, Eric J. Koldinger, Henry M. Levy

April 1990 **ACM SIGMETRICS Performance Evaluation Review**, Pro
1990 ACM SIGMETRICS conference on Measurement and
computer systems SIGMETRICS '90, Volume 18 Issue 1

Publisher: ACM Press

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While much current research concerns multiprocessor design, few traces
programs are available for analyzing the effect of design trade-offs. Exis
methods have serious drawbacks: trap-driven methods often slow down
by more than 1000 times, significantly perturbing program behavior; mic
modification is faster, but the technique is neither general nor portable. T
a new tool, called MPTRACE, for collecting tr ...

12 Measuring limits of parallelism and characterizing its vulnerability to resol

Lawrence Rauchwerger, Pradeep K. Dubey, Ravi Nair

December 1993 **Proceedings of the 26th annual international symposium on Microarchitecture**

Publisher: IEEE Computer Society Press

Full text available: [pdf\(1.39 MB\)](#) Additional Information: [full citation](#), [refe](#)

13 Fast instruction cache performance evaluation using compile-time analysis

⌚ David B. Whalley

June 1992 **ACM SIGMETRICS Performance Evaluation Review** , Proc 1992 ACM SIGMETRICS joint international conference on modeling of computer systems **SIGMETRICS '92/PERFOR** Volume 20 Issue 1

Publisher: ACM Press

Full text available: [pdf\(1.08 MB\)](#) Additional Information: [full citation](#), [abst](#), [index terms](#)

Keywords: cache simulation, instruction cache, trace analysis, trace gen

14 Automatic and efficient evaluation of memory hierarchies for embedded systems

Santosh G. Abraham, Scott A. Mahlke

November 1999 **Proceedings of the 32nd annual ACM/IEEE international conference on Microarchitecture**

Publisher: IEEE Computer Society

Full text available: [pdf\(1.44 MB\)](#) Additional Information: [full citation](#), [abst](#), [citations](#), [index terms](#)
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Automation is the key to the design of future embedded systems as it permits specific customization while keeping design costs low. A key problem for design systems is evaluating the performance of the vast number of alternatives in a timely manner. For this paper, we focus on an embedded system consisting of three components: a VLIW processor, instruction cache, data cache, and secondary cache. A hierarchical approach of partitioning the ...

15 Performance optimization of pipelined primary cache

⌚ Kunle Olukotun, Trevor Mudge, Richard Brown

April 1992 **ACM SIGARCH Computer Architecture News** , Proceedings of the annual international symposium on Computer architecture Volume 20 Issue 2

Publisher: ACM Press

Full text available: [pdf\(1.11 MB\)](#) Additional Information: [full citation, abst](#) [citations, index ter](#)

The CPU cycle time of a high-performance processor is usually determined by the time of the primary cache. As processor speeds increase, designers will increase the number of pipeline stages used to fetch data from the cache in order to reduce the dependence of CPU cycle time on cache access time. This paper studies the advantages of a pipelined cache for a GaAs implementation of the MIPS using a design methodology that includes long traces of ...

16 Optimal tracing and incremental reexecution for debugging long-running programs

✉ Robert H. B. Netzer, Mark H. Weaver

June 1994 **ACM SIGPLAN Notices**, Proceedings of the ACM SIGPLAN conference on Programming language design and implementation PLDI, Issue 6

Publisher: ACM Press

Full text available: [pdf\(1.34 MB\)](#) Additional Information: [full citation, references](#) [index terms](#)

17 Speculative execution via address prediction and data prefetching

✉ José González, Antonio González

July 1997 **Proceedings of the 11th international conference on Supercomputing**

Publisher: ACM Press

Full text available: [pdf\(1.33 MB\)](#) Additional Information: [full citation, references](#) [index terms](#)

18 Eliminating the address translation bottleneck for physical address cache

✉ Tzi-cker Chiueh, Randy H. Katz

September 1992 **ACM SIGPLAN Notices**, Proceedings of the fifth international conference on Architectural support for programming languages and operating systems ASPLOS-V, Volume 27 Issue 9

Publisher: ACM Press

Full text available: [pdf\(1.28 MB\)](#) Additional Information: [full citation, references](#) [index terms](#)

19 Automatic incremental state saving

✉ Darrin West, Kiran Panesar

July 1996 **ACM SIGSIM Simulation Digest , Proceedings of the tenth v
Parallel and distributed simulation PADS '96, Volume 26 Iss**

Publisher: IEEE Computer Society, ACM Press

Full text available: [pdf\(870.62](#)

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We present an Incremental State Saving technique for which the state is inserted automatically by directly editing the application executable. This advantage of being easy to use since it is fully automatic, and has good performance overhead only where state is being modified. Since the editing happens at the assembly level, the method is independent of the compiler, and allows third party libraries to be used. None of the previous incremental state saving ...

Keywords: Parallel Discrete Event Simulation, State Saving, Incremental State Saving, Checkpointing, Time Warp

20 SIGMA: a simulator infrastructure to guide memory analysis

Luiz DeRose, K. Ekanadham, Jeffrey K. Hollingsworth, Simone Sbaraglia

November 2002 **Proceedings of the 2002 ACM/IEEE conference on Supercomputing**

Publisher: IEEE Computer Society Press

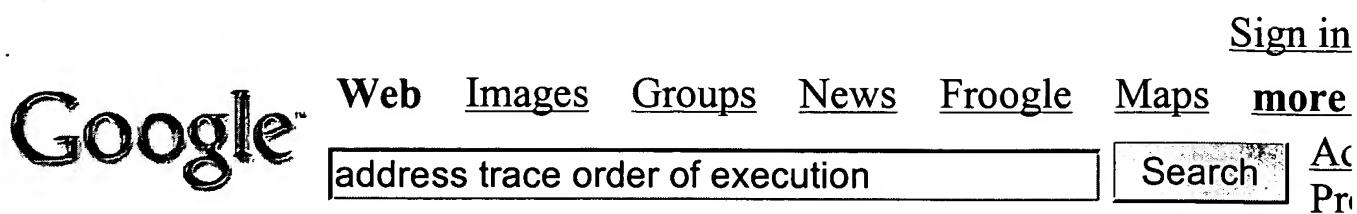
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[KB\)](#) [citations, index ter](#)

In this paper we present SIGMA (Simulation Infrastructure to Guide Memory Analysis). SIGMA is a new data collection framework and family of cache analysis tools. The SIGMA infrastructure provides detailed cache information by gathering memory reference data using a combination of software and hardware based instrumentation. This infrastructure can facilitate quick probing into the memory system to influence the performance of an application by highlighting bottleneck situations such as excessive cache/TLB misses and inefficient data layout ...

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Additionally, the visibility to the **address** bus is unrestricted with a ... data value by starting to work on the instructions in reverse **order of execution**, ...

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